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Yellow Fever, Plague and Typhus —Smoldering Threats¹

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Many of you probably think that the three diseases about which I am going to talk to you today are about as far removed from direct and personal interest to you as an earthquake in Hawaii, or a flood in China. Yellow fever and plague are usually classed with that arbitrary group of human maladies known as tropical diseases, although very few of these diseases are any more tropical nowadays than are colored people or carnations. Typhus probably suggests war-torn lands and long-bearded peasants. But such indifference has no justification. The human animal is endowed by Nature with a wanderlust and an itchy foot, and is forced by present world conditions to take a very active interest in what goes on in even the most remote corners of our planet. The universe may be expanding, but our own particular droplet of it is to

all practical intents and purposes very rapidly contracting. Human beings are today travelling faster, farther and oftener, by car, train, boat and airplane than they have ever travelled before. But the diseases I am about to discuss are much more than threats from without. Two of them are already firmly established in our midst, and the other is less than 12 hours away by clipper plane. And all three of them have very efficient Fifth Columns right under our noses. Franco had a no better reception committee in Madrid or Hitler in Norway than these diseases have in our own cellars, attics and yards.

Let me first expose to you the situation with respect to yellow fever.

In the winter of 1927-28, fourteen years ago, there was great rejoicing in the small but brave army of men who had been fighting yellow fever in the Western Hemisphere. They had been at it for over 25 years, ever since that

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momentous summer of 1900 when four valiant men in the U. S. army in Cuba showed that yellow fever was transmitted by a single species of mosquito, now appropriately known as the yellow fever mosquito. The rejoicing appeared warranted, for a period of eleven full months had passed without a single case of yellow fever being reported anywhere on this side of the Atlantic Ocean. But yellow fever soon showed that it was not the dodo it was thought to be. The first rude shattering of confidence and hope came in March and April, 1928, when fresh cases developed in Northeastern Brazil. A greater shock came in May of the same year when the disease broke out in Rio de Janeiro after an absence of twenty years. Up to July, 1929, locally infected cases cropped up in 7 Brazilian states, and also in Venezuela and Colombia. The latter two outbreaks were in isolated parts in the interior, completely out of contact with other known foci of infection.

But a still more rude awakening came in 1932. In that year there was an outbreak of yellow fever in the Valle de Chanaan in a state in southern Brazil in the complete absence of the yellow fever mosquito. In the same year a still more disheartening and astonishing development occurred when yellow fever raised its ugly head in a small town in Bolivia, entirely isolated from other large centers of population, in the heart of the South American continent, and hundreds of miles from any focus of yellow fever for the past 20 years.

The significance of these facts were so far-reaching that few people were willing even then to accept them. For 30 years yellow fever control had been based on control of the yellow fever mosquito, a domesticated species found only in or near human habitations and breeding only in artificial containers. The out-

breaks of yellow fever where there were no yellow fever mosquitoes, and in places far removed from any known foci of the disease, meant that the carefully planned campaign to eradicate yellow fever from our Hemisphere, apparently on the verge of success, was possibly doomed to failure. The golden age of yellow fever had come to an end and the age of disillusionment had begun.

While these disheartening incidents were occurring, however, great advances were being made in the study of the disease, and two technical procedures of far-reaching importance were discovered. The first of these was the discovery that the immunity to yellow fever which develops after recovery from an attack is so permanent that for the rest of his life the serum of such a person, inoculated into mice with yellow fever virus, will protect the mice against otherwise fatal infections. By this means it is possible to determine with certainty not only whether yellow fever had ever existed in a region during the lifetime of the present inhabitants, but also when the last outbreak occurred and approximately what percentage of the people it affected. In Dallas, for instance, if one found no protective sera in local inhabitants who were under 50 years of age, but did find such sera in people between 50 and 60, and a significantly higher percentage in people over 60, one could be certain that Dallas had had yellow fever in 1891 and also in 1881. This protection test has brought to light some startling facts concerning the distribution of yellow fever, both in space and time. Among other things it has shown that far more people have yellow fever when an epidemic occurs than was ever suspected, and that many, particularly young children, do not have reliable diagnostic symptoms.

The second technical advance was the

invention of an instrument called a viscerotome, by means of which a small amount of liver tissue can be taken from a person who had recently died, without the need of an autopsy. This tissue can be preserved by any local official and sent to a laboratory for investigation. The liver of a person who has died of yellow fever shows unmistakable lesions. Viscerotomy has been applied to many thousands of cases of fatal febrile diseases throughout South America, especially Brazil. Within three years after its introduction 54 cases of undiagnosed yellow fever were discovered, 43 of them from places where yellow fever had never been suspected.

With the help of these new techniques, it soon became apparent that the yellow fever we had known for several centuries, and had confidently expected to exterminate in several decades, was only the occasional bursting into flame of a vast smouldering disease existing in a silent, unseen, unsuspected form in illimitable stretches of uninhabited jungle. We do not yet know what jungle animals serve as the principal reservoirs of the disease or by what means it is transmitted among them, but recent investigations by the Rockefeller Foundation's International Health Division show that many animals are susceptible, and many have protective sera, showing evidence of having been infected. Present evidence points to monkeys and marsupials as the principal reservoirs, and certain jungle mosquitoes as transmitters. Gradually the horrible truth has unfolded that jungle yellow fever exists over a vast area of hundreds of thousands of square miles in South America, from Southern Brazil to Colombia and Venezuela, striking down only an occasional human being who has encroached upon its domain. But when such an individual enters a town where there are yellow fever mos-

quitoes, the disease suddenly bursts into a flaming epidemic which was the only form of yellow fever known to us in the past.

What, you may ask, does this mean to us? I can tell you very quickly. Suppose an American geologist exploring in the South American jungle becomes infected. He could board an airplane in Colombia and land in Miami nine hours later. So yellow fever, lying in ambush within easy reach of nearly every large city in South America, is a constant threat to our own cities since the airplane has made us such close neighbors. Only constant vigilance and prophylactic control of yellow fever's Fifth Column, the yellow fever mosquito, can make us secure against this hidden monster.

Now let us turn our eyes in a different direction. In the same year that our Army commission discovered the method of transmission of yellow fever, an event of far-reaching significance occurred in San Francisco, when a human being came down with bubonic plague for the first time, so far as is known, in the United States. Plague is a spectacular disease for which most people have almost as fanatical a fear as they have for leprosy. Primarily it is a disease of rats and other rodents, and it is transmitted among these animals by rat fleas. The fleas suck blood from an infected animal, the germs survive in the proventriculus and stomach, and in the course of time they multiply so prodigiously that the flea has its digestive tube solidly blocked by a mass of plague bacilli. The embarrassed flea tries in vain to suck blood. The blood reaches the blockage and then regurgitates back into the mouth and into the skin of the animal on which the flea is trying to feed, carrying some of the plague bacilli with it. Rats frequently die of the disease and their orphaned and desperately hungry fleas

then turn their attention to some other source of blood. If that source happens to be a human being, a human case of bubonic plague may result.

Between 1900 and 1904 there were 121 cases and 113 deaths from plague in San Francisco. An energetic rat campaign, in which over a million rats are said to have been destroyed in the city, put an end to the epidemic. But meanwhile fleas orphaned by infected rats that died on the edges of the city turned their attention to ground squirrels and infected them. After this the squirrel fleas took over the nefarious business of transmission. Ground squirrels were reported to have died in great numbers near San Francisco in 1903. In 1909-10 plague was found to exist among ground squirrels in 9 counties south of San Francisco bay. In spite of strenuous efforts to eradicate it, the disease still persists in ground squirrels, after 40 years, in the entire Coast Range mountains from San Francisco to Los Angeles. During that time the disease has twice jumped back into the coast cities, once in Oakland, where 13 of 14 cases died, and once in Los Angeles, where 34 of 39 cases died. The great majority of these cases were of the pneumonic type, but the original cases were in each instance traced to rodents.

Until 1934 nobody in this country outside the southern Coast Range of California worried much about plague. It was introduced to Galveston, Beaumont and Port Arthur along the Texas Coast in 1920, but it apparently failed to establish itself in the only common wild rodent of the coast prairie, the cotton rat, and it was soon snuffed out in the cities by strenuous rat campaigns. But the history in the West was different. In 1934 plague was found to have jumped across California's great central valley to the foothills of the Sierras in the South, and

across the Sierras to Oregon's Great Basin region in the North. In both places ground squirrels were dying from plague like the proverbial flies. Since then plague has been discovered in wild rodents in 11 of 13 western states, from Washington to North Dakota and from California to New Mexico. There is reason to believe that plague had spread to many of these regions before the Public Health Service found it in them. Piecing together the evidence from rodent epizootics it appears that the infection had crossed the Sierra Nevadas at least by 1929, had crept up the coast to Washington by 1930, and had reached the Eastern slope of the Continental Divide in Montana by 1933.

So far plague has been found in nature in 18 different kinds of wild rodents. Three kinds—ground squirrels, prairie dogs and wood rats, all more or less communal in their habits—undoubtedly constitute the principal reservoirs of the infection and principal medium of spread. Ground hogs, chipmunks and tree squirrels seem to be secondary reservoirs. There appears to be little specificity as to the fleas involved in transmitting the disease among the rodents. Nearly 50 species of fleas have been identified on the rodents and more new species have been discovered; 31 of these species have been found capable of transmitting plague to experimental guinea pigs, but some, because they become blocked and infective more quickly, and survive the infection longer, may be presumed to be of more importance than others.

In spite of the wide dissemination of so-called sylvatic plague in our Western States, human cases have been few. In addition to the two epidemics on California mentioned already, there have been 41 sporadic human cases thought to be due to wild rodent origin, and all but 3

of them have been from the Coast Mountain counties in California. One case has been reported from each of the states of Oregon, Nevada and Utah.

It would appear from what I have said that sylvatic plague isn't much to worry about. But I am not sure that this is the case. We do not yet know whether conditions on the Great Plains will be favorable for the spread of plague once the disease has extended to the eastern foothills of the Rockies, but that certainly seems possible. From there it could conceivably spread via wood rats into Southern Texas, and via marmots to other places. Throughout the great area in which it has already established itself, and in whatever additional areas it may eventually enter, it is an unpleasant threat, a veritable sword of Damocles—it is like having rattlesnakes on your golf course or a Typhoid Mary in your kitchen. At any time either of two things can happen. Somebody can become infected from handling a dead animal or being bitten by infected fleas and can then produce a small local epidemic of the pneumonic type of the disease, as has happened twice in California, or, as the epidemic encroaches on the outskirts of a city, fleas may transmit it from squirrels to rats as in the first instance it was transmitted from rats to squirrels, and we may then have a rat-borne epidemic in every way the same as one that might get started by introduction of the disease from the Orient by rats on ships.

Now let us turn our eyes for a few minutes towards another threat, this time existing principally in our Southern States, but one which is yearly becoming more prevalent, and which is slowly but surely spreading north and west. I speak of typhus fever. Just as we have until recently thought of yellow fever as a fiercely epidemic disease spread by yellow fever mosquitoes, and of plague

as a similar epidemic disease spread by fleas of house rats, so until recently we thought of typhus as an epidemic disease spread from man to man by lice, and becoming rampant whenever normal cleanliness and sanitation are temporarily disrupted. One hundred years ago such epidemics, imported from Europe, and called ship fever, swept our Atlantic and Gulf Coast cities. But lousiness was not prevalent enough in America to provide a favorable environment for epidemic typhus, and before the time of the Civil War it had almost disappeared. From 1893 to 1910 there were no reports of the disease in the U. S. It still existed on the Mexican plateau where lice were common, but was unknown in the hot lowlands where lice did not thrive. But beginning about 1915 there were reported a number of outbreaks in the Lower Rio Grande Valley, and even as early as 1913 a case was reported in Georgia. By 1926 cases were being reported in the coastal states from North Carolina to Texas.

Although this disease is clinically in every way identical with classical typhus, it is very unlike it in its epidemiology. It occurs sporadically, not in epidemics; it is most prevalent in summer, not in winter; it occurs among people on whom no lice can be found, and who almost certainly have never been fed on by lice in their lives; and it has a tendency to appear principally in men who work in grain houses, restaurants, groceries, etc. Dr. Maxey in 1928 put two and two together and concluded that our endemic typhus probably existed in rats as a reservoir, being only occasionally transmitted from them to man by fleas or other parasites. His conclusions were soon after proved to be correct.

What the origin of this murine typhus may have been, nobody knows. That it

existed here unrecognized from prehistoric days seems improbable in view of its remarkable spread within the last ten years. It may have been derived from epidemic louse-borne typhus, possibly from the smouldering cases of that disease that still exist in long-bearded tailors and cleaners in New York and Boston, possibly from cases imported into Texas from Mexico. But the fact is that the total number of cases reported in the U. S. increased from 24 in 1922 to nearly 3000 in 1939; in this state, it has increased from 5 to 20 cases a year from 1925 to 1930, to approximately 500 in each of the last four years. In its southern stronghold it had been reported from 158 counties up to 1930, and from 660 in 1939. It has recently extended its range to Tennessee, Oklahoma, and California. In the year 1940 cases were reported for the first time in years or for all time, from St. Louis, Cincinnati, Cleveland, Richmond, and Washington. In Richmond three cases occurred in a grocery store which had imported goods from farther South. The two Cincinnati cases occurred in employees of a paper company importing pulp from Nashville and Atlanta. Two Washington cases oc-

curred in employees at the railway station; one worked on track 21 where trains come in from the South, another in the baggage room. Other scattered cases have been reported in Indiana, Iowa, Minnesota, Illinois and Kansas. Probably not all these cases developed from imported infected rats; very likely many of them resulted from fleas left behind by rats when trains started moving. But in any case it is obvious that here is another constant and increasing threat.

As Dr. Meleney has pointed out, it would indeed be an unhappy situation for the cities of the prairie states if plague from the West and typhus from the South should both reach them in the next decade. Both diseases are on the march, and both have formidable fifth columns ready to meet them in the cities, in the form of domestic rats. Our only defense against any of the three diseases about which I have been talking would seem to be as complete suppression as possible of their respective fifth columns —yellow fever mosquitoes for yellow fever, and rats for plague and typhus. We ought to start the suppression now. Tomorrow may be too late.

What the Biology Teachers Can Do to Support National Defense¹

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Before the echoes of bombs at Pearl Harbor had ceased to reverberate throughout the world, Americans in

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various walks of life began to think of where they might best serve in the defense of America. Americans, it seems, face a somewhat different problem than peoples of many other lands. Where hunger and poverty and tyranny stalk

the land, young men and young women are not faced with the difficult choice of whether to join or not to join the armed forces immediately. No doubt, home ties are as firm in other lands; no doubt children are as beloved; but in other lands there is not so much that is so worthy of protecting and preserving. Social values can never be high in lands where loyalty is not to a way of life, but to a self-appointed leader.

America took up its arms willingly to defend those values it has built—but in taking up arms there were very few who did not do so without some pang of parting with some other activity of equal value in America's preservation. Americans are not regimented by fear and force. In America there is no leader who allots to each one a niche, so throughout the land we find those who are looking for a way in which they may serve, recognizing that if the American way of life is to be maintained, if the gains we have established are to be held, there is a task for everyone whether he may carry a gun, carry on essential civilian activities or participate in the training of those who must share the tasks of defense.

The biology teacher finds himself at the meeting place of two fields of service, a very important crossroad between the sciences allied to Medicine and the sciences allied to Education. Because of this position he is faced with the problem as to which way he shall turn to serve his nation best, and he wonders if he will be fully accepted in either field of service. To those concerned with the establishment of the programs of national defense and with the programs of promoting the growth and development of children no such decision seems necessary for the biologist has a definite place in both of these programs.

What the biologist may do in national

defense may be divided into two types of activity—first, that directed toward the emergency programs connected with disasters, and second, with the long-time program of promoting the growth and development of every child as the surest means of maintaining the defense of America. If emergency situations arise in communities, emergency setups must go into effect, but until emergencies arise, there is no reason to abandon the progress that has been made and the experience that has been gained by those in the field of child growth and development. So it is, that, the organization for emergency will take place on paper—it is hoped with adequate time for careful planning and for making use of the knowledge and the facilities that exist in communities so that adequate training of large groups can be brought about.

According to one form of organization for emergency there are four standard groups. The first deals with medical care and hospital; the second with emergency sanitation; the third with health and medical care training; and the fourth with the local health department which carries on while the other sections are being readied and utilizes the efforts of those developed in the other sections to promote the general community good.

Emergency sanitation will undoubtedly be a very serious problem if bombings occur in this country. Water supplies may be disrupted, sewage disposal systems broken down, food control relaxed, housing facilities strained, garbage and waste inadequately disposed, and rodents and insects left free to spread disease unless the planning provides for definite emergency crews to assist in these various phases of community life.

With disruption of normal service in these lines there is an increased need for laboratory service. Water supplies in-

adequately treated may require frequent examination. Determinations will be made of the extent of pollution through sewage. Possibilities of contamination of milk will be increased and pasteurization may break down, and certainly it must at all times be checked through bacteriological supervision. Foodstuffs may need special analysis; general chemical analysis may be necessary; and control of insects always depends upon laboratory identification of species. The biology teacher in the school is probably going to find a very important place in these activities. Relatively few communities have enough technicians to meet such an expansion of service. Facilities in many cases will be overstrained, and medicine and sanitation and the allied sciences must call for help, and those who are trained with a science background, who have some information of the operation of a microscope, of the biological functioning of tissues, and a basic background for bacteriological and chemical analysis should receive first consideration.

While the possibilities of such services are being set forth in this discussion, it should be emphasized that in no case should any teacher or any individual in a community start out to set up a program, because in every community in America today there is a plan for service, and in war time there cannot be a group of plans interfering with each other. Therefore, any program that might be devised from these suggestions must be cleared with and approved by the Local Coordinator of Defense.

It would seem quite possible that the biology teacher might use a nucleus of students who are learning the techniques of use of scientific instruments and scientific procedures for teams dealing with each phase of this activity. With regard to water, new sources may be

needed. There may be laboratory facilities that can be used for water supplies analyses; there may be students who can be used for assisting technicians in making suitable analyses.

Working with the local health personnel it may be possible to develop a system in collection of milk samples, of food samples or even actual location of insect breeding places and rodent reservoirs in the community. It may be that the biology teacher may actually have to assist in some features of this emergency sanitation program.

Certainly the teacher will have an opportunity to participate in the health and medical care training where broad programs are contemplated, *i.e.*, programs which take into account all of the factors that go into the growth and development of the child.

There will be training for many groups. There will be squads developed to meet emergency in breaks of water or sewerage or food or housing or garbage or environment control facilities; and where such squads are formed, there must be training just as there must be training for those who will handle food in emergency situations. To all of these training programs those with the biological background and with the general science background will be able to contribute much of value.

While these emergency programs will play a most important part in the thinking of the people of this nation for the next few months or years, there will still be other contributions which the biology teacher may make to the lasting success of our democratic way of life. By this we mean participation in the program of true health education or child growth and development. The program of health education in communities today is undergoing a vast change. Recognition is being given to the fact that health

education is not a compendium of catch phrases; it is instead a specific scientific approach to the problems of growth and development. It is in the fields of public health and health education that disappointment and misgivings have arisen. Many of the efforts made during the twenty years since the last war have come more or less to naught, because examinations have again shown that as many or more are unfit to shoulder guns in defense of the nation than were unfit in 1918.

Public health workers, educators, all of those who have gone through the past two decades following the individual specialized program for which their training and occupation equipped them are recognizing that in some way failure has occurred. This failure has been brought about by the fact that there has been no complete coordinated approach to the problems of the child. While there has been discussion of the need of viewing the child as a unit, each group has viewed the child with the single eye of his own training and profession rather than obtaining the true perspective of conditions. It is now recognized that neither medicine, nursing, nutrition, health education, recreation, social welfare, public health, the parent, the home, the community or the school has the whole answer. Success in bringing about the complete harmonious development of children into individuals capable of moving with the most complete efficiency through life can be brought about only if there is a complete integration of the knowledge of all of these fields. Each of these contributes a share to making the environment of the child conducive to his true and complete development.

The biology teacher is in a peculiarly fortunate position because to him comes that opportunity in the curriculum of

to-day of bringing basic knowledge into constructive use. The entire subject matter of biology is capable of interpretation into physiological functioning of the human organism, and the biology teacher should search in every step of planning for bringing to the individual understanding of his own function. It is only by bringing about this understanding, by providing recognition of need within individuals that adequate motivation can be brought about.

From the single cell which is the basis of study, information is gained of all the reactions that are possible to the human organism, and as the study moves from the single cell, knowledge is built up of the human organism as an aggregation of cells working in harmonious or inharmonious relationships depending upon the environment in which they may exist. No study of the child or of the human organism can be complete without a recognition of the factors within the environment, and in the presentation of this information the biology teacher and the worker in the field of public health are operating hand in hand. Progress can be made if the vision is kept broad. The environment must never be limited to the water and the air and the soil. Environment of each individual is made up of all of his fellow men functioning within his universe, and the economic situation of the family, the recreational and social facilities of the community are integral and inseparable parts of that environment. All of these then are factors which must be brought under control and, therefore, there must be interchange of information.

Basic principles with a sound scientific background must be established. Complete understanding between professions and agencies must be brought about. When this is done, an approach will be

made to the therapy of past failures. In that time one will find the biology teacher working with all of the agencies in the community, understanding the programs of all of these, maintaining with all groups and agencies in the community a program which will insure that no phase, no aspect of the building of tomorrow's citizens will be neglected.

THE VICTORY GARDEN AND BIOLOGY¹

"M" day last December was important in the annals of national gardening. Abruptly home gardening became a community necessity. "Defense" gardens became "Victory" gardens. Suddenly the Department of Agriculture requested another million and a quarter more farm gardens raising the total to seven million. Seed men mobilized. Their invoice of the national seed arsenal reveals that it will be adequate.

"M" day also affected the biology teacher in this movement, especially in the urban areas. As spring advances inquiries regarding garden information become more frequent. To answer these inquiries biology teachers are planning a number and variety of contacts. Some plan a series of lectures or symposia on gardening and garden problems; other biologists are setting up demonstration cold frames; model gardens for demonstration purposes are being set out after the danger of frost is past; and others are furnishing seed packets at nominal cost. Others are mimeographing sheets of detailed instructions, handbooks and similar material. Some issue plans for different sized gardens.

¹ The writer will gladly answer any inquiries relative to sources of material or other questions regarding the Victory Garden movement. Be sure to cooperate with your Civilian Defense committee in this work.

The following are a few of the activities and projects which biology teachers may initiate or sponsor to aid in the garden movement.

Community Gardens. In addition to family gardens the biology teacher should sponsor community gardens and neighborhood gardens. There are four essentials for this, namely: land, seed, equipment, and labor. If any one is deficient the project will be handicapped. Be certain that the soil is fertile and workable; the seed source reliable and funds available for purchase of seed in quantity. The equipment must work at maximum efficiency to succeed and labor must have technical direction and careful supervision. The biology teacher should function in this capacity.

Visual Aids. The National Garden Bureau has colored films and slides available for distribution. These may be secured at the cost of return transportation and insurance. They have an attractive poster available at a price of a few pennies. The address is 407 S. Dearborn, Chicago.

Demonstration Garden. Plan and plant three plots of ground. One, with the vegetables needed for a student trial garden, will include from seven to nine vegetables. Another plot, with the vegetables suitable for a family garden, will include about a dozen and a half varieties. Another plot has the vegetables suitable for a truck area. Have signs or student guides for visitors.

Demonstration Cold Frame. Set up a cold frame and have growing seeds for plant seedlings. The demonstration should have suitable signs explaining how the frame is set up and an instruction sheet on how to operate it. Have the demonstration garden and the cold frame demonstration set up in an area available to visits by the public.

Seed Sales. There are agencies which

supply seeds in packets for distribution to school children. They are generally non-profit organizations, furnishing the seed at cost to the pupils. There may be sufficient demand for certain types of seeds so that you may serve as a clearing house and purchase seeds in quantity, saving the individuals the cost of purchasing smaller quantities. You should however see that seed is used economically.

Seedlings for Distribution. Set up a hot bed or cold frame and grow seedlings of the various vegetables. These may be sold at a nominal price to cover the seed cost.

Publicity. Secure the cooperation of your local newspaper on the Victory Garden campaign. Write the articles yourself or have some one help you. If you are unable to do this, contact agencies which supply such a service to the publications, some of them free.

Garden Symposium. Members for this may be interested faculty members and others from the community. Topics for discussion might be: selection of site and planning, soil condition and availability of water; vegetables suitable for the area, easy of culture and common to the community as a suitable food; seed transplanting and other related facts; harvesting, preserving, storage.

Bibliography. Have students prepare a bibliography of books available in the library. Popular current magazines which have gardening articles should also be included.

Bulletins. Each of the forty-eight states has pamphlets available on gardening. These may be procured from the State Department of Agriculture or the State Experimental Station or Agriculture College. The states of Iowa, Kansas, New York, Kentucky and many others have as many as six or more pamphlets on gardening and related topics.

The biology teacher should procure these, as well as publications from the Department of Agriculture and keep them on file for reference and convenience of the community.

Gardening a Biology Unit. Plan a unit on gardening for the spring semester of your biology course. The major objective would be: To learn how to plan and plant vegetables for the different sized victory gardens. The aim is to utilize the available space to best advantage to produce a maximum yield of desirable vegetables. The first problem might be: What are the purposes for planting and the advantages in preparing such a garden? The second problem might be: What is a desirable list of twenty-five vegetables which will grow well in this community and what cultural information is needed for each vegetable? A third problem could be: What plans should be made and what vegetables grown in a small student garden, a family sized garden and a truck garden? Problem four: What facts should be known about seeds, germination, seedlings and cold frames? Problem five: What are some of the important cultural notes and specific information for particular vegetables which would aid in the gardening program? Problem six: What are some of the different methods for preparing foods for cooking, preserving or canning, storage, and other methods for keeping the vegetables until a time when they may be utilized?

Encourage Kitchen Herbs for Gardens. The old-fashioned kitchen herbs are being revived and gaining in popularity. Neighbors might easily turn specialists each to exchange his own specialty with his neighbor. One individual found attractively packaged sage an excellent Christmas gift and greatly appreciated. Kitchen herbs make excellent seasonings for dressings, meats, or fish;

aromatic flavoring for gravies; garnish for salads; pungent scents to preserves and a spicy tang to summer drinks. Prepared herbs are obtained from various parts of plants including dried flowers and leaves, young shoots or bulbous roots, and one or two from bark and twigs. Some herbs listed in your seed catalogues are camomile, thyme, hoarhound, lemon and rose geranium, chives, parsley, Hamburg turnip, Rosemary, rue, and Tarragon "Epiceure."

In conclusion, the food problem will be one of the factors in winning the war and some state in writing the peace. Be judicious about the projects. Utilize waste or idle land in place of plowing and digging up existing beautified landscaped areas which are just as essential to morale. Use seed judiciously, buying the quantity which has been computed previously as being sufficient for your needs. Substitute some other variety if a specific variety is scarce or difficult to obtain, even substitute other vegetables if you have difficulty obtaining certain seed varieties. The biology teacher must remember that even if he does not have actual gardening experience there are still numerous ways he can be of assistance in the movement.

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THIS DEFENSE ISSUE

The original dummy for this issue consisted of a few hurried penciled scrawls on the back of a used envelope, fished from my pocket, together with a sheet of Dallas hotel stationery. They are here beside me now serving as a final check on the progress of our thinking regarding the plans for the issue. These notes were made at the annual meeting held on the eve of this year. One by

one we were becoming nervously apprehensive, as we individually were recovering from the numbing shock of Pearl Harbor, anxious that something be done. We were all of the opinion that **THE AMERICAN BIOLOGY TEACHER** should have a Defense Issue.

A year prior to this meeting I had asked to be relieved of the duties of associate editorship. My request was granted but kindness kept my memory green honoring me with an Advisory Staff membership. Now a year later your new editor, Mr. John Breukelman, exercising his prerogative, asked if I would aid with the defense issue. Our immediate problem was to get such an issue out before the end of the spring school term—permitting it to do some effective good.

The response from the editorial membership was splendid. I am sorry that I was unable to answer each member as soon as his communication was received. The time was short; there was only a period of six weeks to make our contacts, secure our copy and go to press. There was no time to polish off a planned and well-organized issue. We took pot luck. Time would not permit us to proceed in any other manner. However we have a good cross-section of what is possible in this war effort. It may not be as detailed nor complete as it might have been. More time might have permitted different balance. The end of this emergency is not in sight and there is yet room for subsequent articles and material on biology and national defense. Give editor Breukelman your support.

In conclusion I wish to thank the editorial staff for their excellent support and cooperation. Each contributor also deserves special praise for his consent to work under pressure. Readers should remember that contributors, staff members and officers work without pay. We

have a nonprofit organization—you may help by giving the journal its support.

M. C. LICHTENWALTER,
*Guest Editor National Defense Issue
and Advisory Staff Member.*

WHAT CAN WE DO?

In this period of grave national crisis many patriotic citizens feel distress at their inability to discover ways in which they can be of service. From the standpoint of biology teachers, *THE AMERICAN BIOLOGY TEACHER* is trying to present in this issue some things we can do and some ways in which we can do them. The suggestions come from a variety of sources, not just from biology teachers, but from the pupils, as well as research biologists and state and federal health services—all of them indicating ways in which biology and biology teachers are helping and can help to make the United States of America worthy of her heritage.

Biology classes are logical centers for the study of such fundamental aspects of our national strength as first aid, personal and public hygiene, sanitation, prevention of infectious disease, vitamins and their associated diseases, the preparation, storage, transportation and conservation of food, healthful diet in the face of rising costs and shortages of certain foodstuffs, Victory Gardens, efficient growth of food crops, improved animal husbandry, crop substitutes, insect control, and many other kindred subjects that are of immediate importance.

Taking a somewhat longer view the biology teacher sees the responsibility that may be his in helping our people to distinguish between righteous anger and blind hatred. A study of the biology of the human species can do much to help in the efforts to carry this war

to a victorious conclusion without the hatreds which will interfere so seriously with the difficult task of post-war reconstruction.

This is a special issue in the sense that we concentrate on the theme of National Defense. We shall of course continue to devote much space to what is uppermost in our minds and hearts—helping to build a strong America. In this number we are only scratching the surface. For future issues we welcome contributions in all of the above subjects, as well as many others not mentioned but perhaps equally fundamental. They may be in any form—articles, news notes, editorial comments, addresses or abstracts of addresses, summaries of local programs, symposium reports, letters.

Thanks are due Mr. M. C. Lichtenwalter for the manner in which he handled the task of getting material for this issue, and to the contributors for their promptness and their cooperation in working under time pressure. Most of our readers probably do not realize that such a magazine as this must always be in preparation several weeks ahead. For example, the manuscripts in this number went to the printer on February 24; many of them were in the editor's hands by the 10th.

JOHN BREUKELMAN.

OUR ROLE IN A NATIONAL HEALTH PROGRAM

The National emergency now confronting us has made health protection doubly urgent, in fact imperative. What are we doing to help this important problem?

The biology teacher over the years has had a wonderful opportunity to educate the future adult citizenry to be health-conscious. It is through this channel that parents and future par-

ents can be trained to realize the value that strong, healthy bodies exercise in producing healthy, disease-resistant offspring with inherent capacities for solving our present and our future problems. Why haven't we done more with this opportunity? We haven't, for in the past, and even at the present, few students in proportion to the entire number enrolled in the schools of the United States take biology. Since this is the case, it is up to the biology teacher who is teaching to make his course so vital and practical that the student not enrolled in biology will realize his need for this subject. The teacher's best advertisers are his students and his own knowledge and enthusiasm for the course.

The "Conservation of Human Life" unit surely stands out as a challenge to every biology instructor to make the most of what such a unit presents. In a natural situation the well-versed teacher can so impress the student with this invaluable material that mental attitudes will be set up that will aid the individual in all future living. When healthful and wholesome living can be established in the youth at this age a foundation has been laid for the future betterment of a nation, as well as for the future happiness of the individual. Health is accepted as the greatest heritage for human happiness. Without a

Your attention is called to the fact that the first two articles in this issue were presented as part of the program of the national meeting at Dallas, Texas, last December. As indicated in the February report of this meeting, other parts of the program are scheduled for publication in future numbers.

doubt, biology gives the teacher a most excellent opportunity for establishing in the student the value of observing health habits and rules.

Biology teachers, we do have an important role to play in the molding of the future thought of our young people in establishing a National Health Program. Let's fulfill our duty and put every ounce we possess into our teaching to awaken in our youth the importance of health and the preserving of this health for all future mankind, so that man will not through his weaknesses destroy himself.

HELEN TROWBRIDGE,
*Glenbard Township High School,
Glen Ellyn, Illinois.*

COMMENTS FROM BIOLOGY TEACHERS

The correspondence relative to the National Defense issue included many interesting statements concerning the activities of biology teachers over the country. I am including here some representative excerpts. The remarks were unsolicited and not in reply to any generally directed question.—M. C. LICHTENWALTER, *Lane Technical High School, Chicago.*

"Some time ago I was appointed Chief Air Raid Warden Instructor for Northeastern Pennsylvania. This together with my work at the college has me snowed under."—ELWOOD D. HEISS, *State Teachers College, East Stroudsburg, Pennsylvania.*

"I am teaching Red Cross First Aid one night per week to a class of Librarians in Springfield, Massachusetts."—EUNICE E. SHARP, *Chicopee Falls High School, Chicopee Falls, Massachusetts.*

"We are spending considerable time at High School in air-raid precautions,

since Dayton is a key city in air-raid defense. My high school laboratory is to be set up for a first-aid station and we try to do what we can with high school training in first aid methods as part of the biology set-up. In my college work, I have mostly pre-medies and nurses in my classes, and we are rushing them along through four years in three, to be available for work in war areas for medical need."—B. BERNARR VANCE, *Instructor, Science Division, University of Dayton, Dayton, Ohio.*

"I am taking the first aid course and using a pamphlet on First Aid printed by Metropolitan Life Insurance Company in my classes. I am also enlarging the unit on Conservation. War is the great waster; we can conserve even in war times."—J. L. SLOANAKER, *North Central High School, Spokane, Washington.*

"At present I am working on Consumer Biology."—MELVIN A. HINTZ, *South Milwaukee High School, South Milwaukee, Wisconsin.*

"May I say that there have been many opportunists who have been using the national defense plea to accomplish what normal times would not permit them to accomplish. Has not biology been working for national defense in its whole program for years? Why do I teach nutrition if it is not to make America strong? Why have I been leading future voters to be conservation minded? Of course we are not 'I told you so' people, but let us make our national defense contribution by doing much better many of the things we have been trying to do through the life sciences."—RAY KENNELTY, *DuBois High School, DuBois, Pennsylvania.*

COMMENTS FROM THE PUPILS

In Detroit, high school biology pupils were asked, "How can biology help with national defense during the war and after?" The following are excerpts from their answers:

"A knowledge of biology will be useful to us during our whole lives. During a war when plagues and diseases are spread, a knowledge of disease prevention is very useful. It is essential many times that first aid be rendered immediately and correctly. Biology teaches how to conserve human life. This is important both during a war and afterwards." *Alice Hathaway—10B.*

"The words National Defense do not mean only the building of tanks, airplanes, and boats, but they mean the building of strong bodies and minds. This is where biology plays a major part. It tells us what to eat, and why; what foods contain the most vitamins, and why we need them. Biology shows us how and when to plant gardens so as to get the best results. We need to know something about soils and plant preferences." *Ralph Doerfling—10B.*

"Important in keeping up our morale is keeping up our health. You have probably heard someone say, 'Everyone is doing something for national defense. I want to help, too, but what can I do?' That person may not realize it but he can be a great help by just taking good care of his health.

"Essential to good health are the right kinds of foods. While our country is at war we must learn to get along without luxuries. We must know which foods have high food values. We will need to buy only the essentials." *Marion Shaw—10A.*

"With a knowledge of biology we can help our nation during this world crisis. We should know what types of food are needed to keep us well and strong. The first duty these days is to keep health rules so that we will keep fit, and so save worry and waste.

"A thorough knowledge of First Aid is a requisite during war or peace. The First Aider saves valuable time for the doctors by taking care of the preliminary treatment for victims of explosions, aid raids, and so forth.

"Conservation of everything is vitally important. The liquids from cooked vegetables should be saved and stored in the refrigerator for use in soups. A vegetable garden could be planted and the vegetables canned for winter use. These are only a few of the things that we can do to help in the conservation program that is now being launched by our Government." *Margaret Grab*—10A.

"Biology is going to prove very helpful in the next few years, not only to students, but to all people. The whole nation will be aware of the following biological tie-ups:

"*Gardening*—A well kept garden brings pride and self-respect, no matter how large or small it may be. Such a garden is a sign of good citizenship, for the proper feeding of the people has become a national problem in every country.

"*Food*—Ignorance and carelessness account for many more cases of malnutrition than poverty. Often it is the failure to get enough food of the right kind. In time of war when prices soar, we should strive to obtain the necessary strength-giving foods, and if necessary, leave off those which are non-essential.

"*Knowledge of substitutes*—In wartime, when essential products are not

available, substitutes become very useful. Scientists are daily making important discoveries based on the use of plants.

"*Conservation*—By replacing those natural resources which can be replaced and by using only what is absolutely necessary of the ones which cannot be replaced, we will have no major conservation problems after the war.

"*First Aid*—The knowledge of first aid is essential in the home, in school, in factories, stores and in other places of business. It is useful at any time, during peace or during war.

"*Personal Health*—The greatest problem of all is that of personal health. If each citizen would take care of his own needs individually, the lack of doctors and nurses would not seem so great in an emergency such as might befall us at any time in the near future." *Pearl Parker*—10A.

"Biology is the science of life, and in 1942 it is the science of life saving. The greatest evidence of biology's services to America can be seen in the numbers of men, women, and children receiving instruction in first aid throughout the nation. These people want to be prepared for what may come. Without biology, such knowledge would be impossible, and without the knowledge, victory would be improbable. A world ignorant of antiseptics, surgery, disease treatment, and correct diagnosis would be a pain-wracked one.

"American men fight on the world's battlefields today, but it is American youth who will fight America's battles tomorrow. These young people must be strong, in mind and in body, that the burden which will be theirs shall not weight upon shoulders too weak to bear it. It is the job of biology and of biologists to see that they have adequate

health education, and that they lead wholesome, fruitful lives." *Zane Laidlaw*—11B.

Submitted by

BETTY LOCKWOOD,
Redford High School
Detroit, Michigan.

A SYMPOSIUM ON NATIONAL DEFENSE

The Chicago Biology Round Table met at the Piccadilly Restaurant, January 23, 1942, for a symposium on the subject "What the Biology Teachers Can Do for the Defense Program."

The guest speakers were Dr. Henry Niblack, Chief of the Child Welfare Department of the Chicago Board of Health and Miss Ethel K. Benson, of the Chicago Chapter of the Junior Red Cross. Emphasis was placed on health as a part of the defense program.

Several of our members took part in the program. Mr. Myrl C. Lichtenwalter spoke about victory gardens as a project for the high school students. He stressed economical use of seeds and cautioned against overbuying and overplanting. Mr. John E. Coe, our Vice-President, spoke briefly on war gasses.

Among the more important considerations of the symposium were the following:

1. There is need for a more complete school health program in which positive health is taught. It is necessary that the civil population be healthy so that the workers may be kept working. Fourteen men are needed at home to keep one man at the front.

We are well organized in problems of health. It is important to keep the organizations going as normal as possible.

2. Care of the teeth should be emphasized, with periodic visits to the dentist

to have corrections made. If necessary, free dental care should be given. Only 50% of our young men were fit for service. Poor teeth was the No. 1 cause of deferment of those unfit.

3. Malnutrition must be avoided. There is a fund of scientific knowledge regarding nutrition and well balanced diets with sufficient food elements and vitamins to maintain good health. This knowledge should be disseminated.

4. Cases of tuberculosis and contacts should be separated. As a result of the depression there has been an increase in tuberculosis in certain groups that were poorly fed and housed. Better housing should be provided and admission of patients to sanitariums made possible.

5. It is necessary to create a healthy state of mind in order to avoid nervous disorders and breakdowns. Mothers, especially, should be taught a positive health attitude and trained to size up their children in regard to their physical and mental health.

6. We must prevent outbreaks of typhoid fever, intestinal diseases, measles, scarlet fever and poliomyelitis by rigorously applying our knowledge of sanitation in places where there is over-crowding and a lower standard of living due to the mushroom growth of factory cities and trailer camps.

7. We shall soon have to conserve medical service. Doctors and nurses are being called to army service. Now is the opportunity to bring to the attention of home-makers the importance of courses in home nursing. We must stimulate the interest of Junior and Senior high school girls, and out of school adults in the special training given the Nurse's Aid. There is also opportunity to become certified First Aid instructors.

8. The Junior Red Cross offers opportunity to humanize classroom work,

foster a spirit of service and give practice in actual citizenship. For example, potted plants can be cultivated and distributed to the hospitals. Labels and information regarding the plants provide additional interests for the recipients.

The Red Cross Magazine furnished material for the study in the classroom of the Red Cross and its activities.

The Victory Book Campaign and the Blood Bank Service are other activities of the Red Cross in which we may participate.

9. Miss Thelma Jones, our president, reviewed Dr. E. Lawrence Palmer's article in the January number of the *Nature Magazine* entitled "About Us and the U.S.A." Miss Jones proposed that the Chicago Biology Round Table follow Dr. Palmer's suggestion and direct the soldiers and sailors off duty to the various Natural History sites in and about Chicago. Lists of places of interest with directions as to how to reach them can be posted in the Public Library, and bulletins regarding these places be made available. Members might serve as guides on personally conducted tours and provide bird trips and nature trails. Nature trails and hikes in the Dune Region of Waukegan should provide recreation for the boys at the Great Lakes Naval Training Station.

ESTHER A. OLSON,
*Corresponding Secretary, Chicago
Biology Round Table.*

A LETTER FROM CALIFORNIA

Editor of *The American Biology*

Teacher

Dear Sir:

I hope this information reaches you in time for the next issue of the magazine. Mr. Charles Herbst gave me the notice

a week ago but like many of the teachers on the Pacific Coast I was taking a stream-lined course three hours per night for the First Aid Instructor's certificate.

I believe you may wish to know about our Red Cross activities in Southern California. The high schools are adding many classes this semester, following a new law requiring a standard First Aid certificate of all graduates from California high schools.

In some schools there is a 100% requirement for *all* teachers to have a standard Red Cross certificate since December 7, but most schools have an average of 90% of the teachers in First Aid, Nutrition, Canteen Work or Home Nursing classes. Many of our teachers are taking two courses at one time. In my own high school—Lincoln—we have a First Aid and a Home Nursing Class. Every teacher except a few who are physically handicapped are taking one or both classes.

I called the officers of the Life Science Association and they tell me the same is true in their schools. Mrs. Dodson, recording secretary of the Life Science Association and of our City College faculty, told me that fourteen teachers have their Instructors' cards and twenty-five are getting theirs and that 50% of the student body, numbering 6,000, are enrolled in Defense, First Aid, Nutrition or Canteen Work.

We are giving our students in junior and senior high school, a junior course in First Aid which will be followed by a standard course in the 12th grade.

Los Angeles had 17,000 adults enrolled in Red Cross classes in January. These figures do not include junior or senior high school students. The biology and physiology as well as physical education teachers are taking on evening classes to

help teach the adult population which is clamoring for this instruction.

Mr. Charles Herbst is teaching First Aid in Beverly Hills night school. I intend to conduct, in a short time, a Saturday morning class in junior First Aid for Camp Fire Girls.

Our Association is extremely busy. I cannot give you exact figures, but from personal friends in other schools I hear only the same story of tremendous interest in Red Cross work among teachers, pupils and the general public.

I did not have time to make a real study of the situation here in Southern California, but it is safe to say that there are very, very few members of the Association who are not engaged in this work. We realize our danger and realize we must be prepared for all emergencies.

Very sincerely yours,

LILLA M. ARMSTRONG,
President of the Life Science Association of Southern California.

APPLYING NUTRITION INFORMATION*

The present emergency, which dramatizes food needs, places squarely before all teachers both the opportunity and the obligation to extend their influence. Most of you have long been preaching and teaching the vital importance of food for health, but the audience has been, I fear, a very limited one. We all know that a great many folks have continued to jog along in the horse and buggy stage as far as their food habits are concerned.

Today, nutrition is news. It is the popular topic for club programs, radio skits, and study groups. Everyone wants to hear or help spread the gospel of good nutrition. The campaign for better nu-

trition is a challenge to all of us. Federal agencies, particularly the Department of Agriculture, have long been in the field doing research, training and education. State, local and private agencies and individuals have done much of the groundwork. To organize the national nutrition program a nutrition division has been set up in the Office of Defense Health and Welfare Services. This division is a clearing house and coordinating agency for nutrition activities at the Federal level and acts in a consultant capacity to the States. But to be effective, the national nutrition program must look to State and local committees to do the basic job. It is the responsibility of these committees to plan and carry out action programs which are adjusted to the needs of their particular localities. If this program for national improvement in nutrition is to get results it must reach down to the "grass roots" folks.

Here is the chance of a lifetime for all science teachers. We must be ready to take leadership and to guide this new interest in nutrition into sound channels. We must take stock of our own qualifications for spreading the nutrition gospel. *First*; do we have good food habits ourselves? *Second*; are we familiar with the social and economic factors in our communities which might affect food habits? *Third*; are we so well-grounded in our knowledge of nutrition that we can interpret it in simple terms to the layman? *Fourth*; are we using the most intelligent and understanding methods of approach to various population and age groups? When we can answer these four questions affirmatively we are ready to help make the right kind of food a reality in every American home. If we are not qualified to teach nutrition, we must ask help from those who are.

The nutrition program is a long-time

* Abstract of an address before the New England Biological Association, Boston, Massachusetts, December 6, 1941.

program. Certain parts of it must be on an emergency basis, and for these immediate needs national defense is a strong motivating force. But, as a recent writer in *Fortune Magazine* so aptly put it . . . "A child of war, the United States nutrition program may well be the parent of peace. . . . Our national nutrition program looks beyond victory and lays the foundation for a better world in the future. For the war emergency has merely precipitated and dramatized a sweeping movement whose ends far transcend the present conflict; health and strength for all the people all the time."

DR. HELEN S. MITCHELL,
*Nutritionist, Office of Defense
Health and Welfare Services.
Washington, D. C.*

ECOLOGY IN A WORLD AT WAR

The philosophy of helping the student understand his environment has always provided a worthwhile foundation for the study of biology. During 1941 it became increasingly obvious that the whole world constitutes our environment. Therefore, when I began thinking in August of a possible approach to biology for the fall, it seems natural to find a way of developing the world outlook.

MOTIVATION

During the first class, the discussion centered around the question, "Do we know any war materials which come from plants or animals?" The most frequent answer was "Rubber." After pointing out the Dutch East Indies as the chief source of raw rubber, we went on to other strategic materials from countries outside the United States.

After deciding that biology could be studied through the economic importance and distribution of raw materials, we began with the United States, in order to learn what materials we already had.

METHOD

A large muslin wall map of the United States, marked out with the life zones of Kinsey's *New Introduction to Biology*, formed the background from which we planned our research reading. Each pupil selected a topic from the following outline:

1. Life, habits, distribution and economic importance of some animal.
2. Life, distribution and economic importance of some plant.
3. Soil, climate, especially rainfall, of the zone selected, with a list of the commercial products.

The members of the class made their plans in advance, listing the subjects chosen. This helped to avoid duplication and provided more thorough coverage of the zone whose life was being discussed. Each student prepared a written summary of his own reading. As many as possible gave their reports orally. The others kept notes on all reports, thus each student had a reasonably complete outline of the whole subject.

It was noted that Canada could be divided into zones continuous with those of the United States, such as the eastern forest, the midwestern and prairie zones as well as the Rocky Mountain and the Vancouverian.

For the remainder of the world it was necessary to study larger areas at a time. We followed roughly the regions outlined by Baker and Mills in *Dynamic Biology*, namely, North America, South America, Eurasia and the Orient, Africa,

Australia, using the same method outlined above.

VISUAL AIDS

Each student received outline maps of the zones and regions. Upon the maps or accompanying charts the valuable biological products were listed. Some pupils varied the procedure by pasting pictures of animals and plants on their maps.

Wall outline maps were made copying small maps on heavy-gauge cellophane cut to the size of lantern slides ($3\frac{1}{4} \times 4$ inches). The drawing was done with India ink. Projection of the image on a sheet of chart cloth hung on the wall made it possible to draw a permanent map on which any desirable data could be recorded.

Advertisements of specific products, newspaper articles and the like contributed significant material. For example, the drug products of the world are shown on a map published by McKesson & Robbins, Inc.

OUTCOMES

The members of the class feel that they can understand the strategy of the war better when they know that much of the action is planned for the conquest of materials. In answer to the question, "Why does Hitler want eastern Russia?" research showed the presence of oil and wheat, whose value they have come to understand. It was a satisfaction to many that they already knew of the rubber plantations in Sarawak before the recent Japanese raids brought that area into the news. The significant sociological fact of economic interdependence was one of the broad outcomes of the two months spent in this study.

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EUNICE SHARP,

*Chicopee High School,
Chicopee, Massachusetts.*

GROWING PLANTS FOR VICTORY GARDENS

This experiment combines the purposes of observing the growth of plants as an entity and the growing of plants for use in the home garden. The desire of the students in my classes to grow plants for use in their victory gardens is largely responsible for introducing this experiment as a part of our laboratory work in our general course in Biology.

We are growing cauliflower, tomato, pepper, salvia, aster and geranium plants for this purpose.

Flats were made from scrap wood by the woodworking shop. These flats are twelve inches wide, twenty-four inches long and three inches deep with a crack of $3/16$ inches between the boards on the bottom of the flat. The sieves were made from hardware cloth.

The seedling soil was mixed as follows: $\frac{1}{3}$ black loam, $\frac{1}{3}$ sand, $\frac{1}{3}$ peat. These were thoroughly mixed and screened through a Number 10 mesh sieve. The loam should be low in animal excreta as the presence of organic fertilizers often causes bacterial rots.

The flats were first filled with a one-inch layer of gravel for draining. Next the flats were filled to within an inch of

the top with seedling soil. Then the seeds were planted. We sterilized the seeds by shaking them thoroughly in a jar in which there was a small amount of Semesan dust.¹ They were placed at a depth twice their diameter. The flats were placed on a plant table. We covered a table top (having a raised edge of one and one-half inches) with galvanize for this purpose. It was placed in the sunniest part of the room. We placed about one-half inch of coarse gravel on the table top and placed the flats on small sticks of wood to provide aeration. Labels were then affixed with the variety of seed, date of planting and planter. Where damping-off occurred the seedlings were watered with a liquid Semesan solution made up as follows: four and one-half grams of Semesan powder to one liter of water.

Watering is done with a bulb spray to avoid washing of the soil. The soil is kept moist but not wet. Excessive drying of the soil is prevented by covering the flats with a pane of shaded glass. Upon germination the pane of glass is raised about an inch each day for three or four days (then removing the glass). The soil is now allowed to become fairly dry between waterings but is not permitted to stand dry.

The seedlings are transplanted when they have two to four leaves (including cotyledons). They are removed from the flats with a putty knife with some of the soil. The transplanting soil is prepared as follows: 1 part sand, 6 parts black loam and a light sprinkling of Vigoro.² The flats are filled level full with this soil after it has been run through a Number 4 mesh sieve. The seedlings are set in the soil deep enough so that the plants stand firm and the roots

are well covered (about $1\frac{1}{2}$ inches each way). The soil is pressed firmly about the plants. The flats are watered thoroughly and set in a shady location for a few days until the plants become established. The temperature is maintained between 60-70° F.

Each student has one flat and is responsible for its care. Only one variety of seed is planted in each flat. When these plants are ready for transplanting into the victory garden the students will exchange plants according to their needs.

We are also growing hormone-treated cuttings. Three- to four-inch-long cuttings from geraniums are treated with alpha-naphthalene acetic acid (1 milligram per 100 grams of tale). At the time of cutting the cut end is put in the powder. That which adheres to the cutting is sufficient for the treatment. The cuttings are removed from the plant just above the leaf nodes and defoliated excepting for the topmost two or three leaves. Geraniums treated in such a manner are ten days ahead of the untreated cuttings.

The cuttings are placed in coarse sand in a flat which is five inches deep. A frame was built over the flat and covered with muslin. The sand is watered and pressed down solidly. An incision is made in the sand with a putty knife. The cutting is set $\frac{1}{2}$ to $\frac{3}{4}$ of an inch deep. The sand is kept damp but not wet. When the roots are well established they are transplanted to $2\frac{1}{2}$ -inch flower pots. The soil is prepared as follows: 4 parts of heavy loam to $\frac{1}{2}$ part of organic fertilizer. A three-inch flower pot of superphosphate is added to each bushel of soil.

The students will take these potted geraniums home where they will transfer them to four-inch pots or window boxes. We hope to have three geraniums for each student. A study of the better

¹ Bayer-Semesan Co., Inc., Du Pont Bldg., Wilmington, Del.

² Swift and Co., Calumet, Ill.

varieties of these plants for this area is being made.

This experiment is making Biology function in the lives of the students as well as their parents.

C. CLAIR CULVER,
Ellsworth High School,
Ellsworth, Iowa.

CHEMICAL WARFARE

The course of study of Hitler youth includes the study of the nature, manufacture, use and effects of the war gases. In this, a totalitarian war, aimed at the subjugation and extermination of enemy peoples, the study of these powerful agents may well have a prominent place in our curriculum. One of their chief uses will be to spread panic in an unprepared and untrained population and to destroy communications, supplies and transportation facilities. The development of the long range aeroplanes makes possible the dissemination of such gases at long distances from the centers of conflict.

It is generally held, that terrible as war gases are, their effect must continue to be local; that no war gases have been discovered that can wipe out whole cities; that they would be relatively ineffective against a population which is properly prepared and trained; and that they are expensive to produce.

Of the more than three thousand chemicals experimented with in the first world war as war gases, only about twelve were in use at the close of the war and only about five of these were considered successful. In addition to being toxic, a war gas must be stable enough that it does not decompose on storage, heavy enough that it will remain close to the earth, safe enough that it can be handled, and cheap enough that it can be produced in quantities.

All the successful war gases had been known by chemists for many years before the outbreak of the war. Nearly all of them contained chlorine. War gases may be gaseous, liquid or solid. Mustard and chloropierin are liquids, and the arsenicals are solids which must be dispersed by explosion.

There are several methods of classifying the war gases. A convenient method is according to the part of the body affected: (1) vesicants or blister gases; (2) asphyxiants or lung injurants; (3) paralysants or nerve destroyers; (4) lachrymators or tear gases; (5) sternutators or sneezing gases. The first three are intended to cause death, while the last two are irritant gases not causing death in the concentrations that can be obtained in the field. Gases which remain effective for more than ten minutes in the open are called permanent. The more efficient gases combine several of these properties, thus lewisite is primarily a vesicant but it is also a sternutator and lung injurant. The permanent gases are the ones most likely to be sprayed from aeroplanes while any of them can be distributed by bombs.

When the improved gas mask with its charcoal and soda lime and its felt filters gave protection from most of the other gases the Germans introduced the permanent vesicant mustard gas, the cause of more than eighty per cent of the casualties and eight-ninths of the deaths caused by gas during the world war. It is a black or brown liquid which vaporizes slowly, the heavy vapour collecting in ravines and shell holes. Its action is insidious, symptoms being delayed for two or more hours. Contact with the liquid is much more serious than exposure to the vapour. Breathing the vapour leads to fatal lung inflammation and pneumonia. Mustard gas readily

penetrates rubber, leather and common clothing. As small amount as one milligram per liter of air causes severe conjunctivitis after an hour's time. The blisters formed by mustard gas are deep-seated, slow to heal and subject to infection. The effect is probably due to the liberation of hydrochloric acid within the cells.

Because mustard gas has but slight odor of mustard, it is one of the most difficult gases to identify in the field. This may require the services of a trained gas warden. It is only slightly soluble in water (one per cent), but it is readily soluble in organic solvents and in animal and vegetable fats. It has slight solubility in mineral oils, vaseline and paraffine so that these substances are used as protective salves. Oileloth or clothing saturated with boiled linseed oil and paraffine are nearly gas proof. Strong alkalies such as lye readily neutralize mustard gas and it is destroyed by oxidizing agents such as potassium permanganate, hydrogen peroxide and bleaching powder (calcium hypochlorite).

In preventive treatment, speed is essential. If the person is exposed to the liquid, even a few minutes delay may be very serious. The patient must be evacuated from the gassed area then the clothing removed and the liquid soaked up with pledgelets of cotton, the attendant using rubber gloves and being careful not to spread the liquid; then the exposed area should be bathed with a solvent such as gasoline, kerosene, methyl alcohol or carbon tetrachloride. This should be followed by an application of wet bleaching powder or of bleach ointment made of equal parts of white vaseline and bleaching powder or of chloramine T in a vanishing cream. Keep the bleach out of the eyes and remove it after about one minute by washing

with warm water. Then wash thoroughly with soap and warm water. If blisters have already formed omit the treatment with the bleaching powder. The eyes, throat and nose should be washed with a 1 to 2% solution of sodium bicarbonate, with saturated boric acid solution or with normal saline. After thorough washing, a drop of paraffine oil or of castor oil should be added to prevent the lids from sticking. If one is exposed to the vapour the case is much less serious. The body should be bathed thoroughly with soap and hot water and the clothing changed.

Lewisite is a strong, fast-acting, irritant vesicant, which has a strong geranium-like odor. It is readily hydrolyzed by water but it forms an oxide which is a nonvolatile vesicant. When absorbed into the circulation, lewisite causes systemic arsenical poisoning. This can be prevented by treating the exposed part of the body with a five per cent solution of sodium hydroxide. Lewisite was not used in the first world war, but large quantities were on the way to the front. This was destroyed by sinking it in the sea.

The chief asphyxiant is phosgene, a true gas, with a transparent, stifling, hay-scented vapour which is 3.5 times as heavy as air. It is soluble in its own weight of water and in organic solvents. It is very poisonous, one or two breaths being fatal within two or three hours. Its toxic effect is increased by exertion. Its entrance to the lungs increases the permeability of the capillaries and the lungs fill up with liquid, so that the patient is said to drown internally. Treatment after removal from exposure is to keep the body warm and to remove all strain. Transportation should be lying down. Warm coffee may be given as a stimulant.

Chloropicrin, or vomiting gas, is a

lung injuriant. It is a colorless oil with a boiling point of 112° C., so that it was generally used in shells with other gases such as phosgene or chlorine. It gives off a pungent, irritating vapour which is 5.6 times as heavy as air. It has a sweet, anise-like odor and is a strong lachrymator causing severe crying, coughing and vomiting. Its treatment should be similar to that in the case of other lung injurants.

The paralysants are hydrocyanic acid, hydrogen sulfide and carbon monoxide. These extremely poisonous substances were of little value in war since they are gases at ordinary temperatures and these are lighter than air. They require special absorbents so that the military mask offers little or no protection. Artificial respiration with oxygen and carbon dioxide must be begun immediately.

Brome acetone was the most important lachrymator of the first world war. It is a heavy liquid, boiling at a high temperature and it is insoluble in water but is hydrolyzed by alcoholic alkalies and decomposed by sodium thiosulfate. It produces painful but quickly healing blisters on contact with the skin. Its main action is the production of an intense smarting of the eyes, a spasmodic winking, and a profuse flow of tears, but normally it does no permanent damage. The eyes should be treated with warm salt solution.

Diphenyl chlor arsine and diphenyl cyan arsine, were the two most important sternutators. They are solids which are dispersed by explosion, so that they form toxic smokes in which the particles are of ultramicroscopic size. The felt of the modern canister filters them from the air. They cause pain in the nose, throat and chest and are accompanied by nausea and mental confusion. Their effects are

temporary, but they develop rapidly and persist for several hours. They are efficient in very small concentrations of one part in fifty million of air. They are insoluble in water but are readily hydrolyzed by alkalies and oxidized by the ordinary oxidizing agents.

The harmful effects of gas can be largely overcome by careful preparation and concerted action while gas raids are in progress. Provision of gas masks, gas proof clothing, and shelters, trained personnel, first aid, medical service, ambulance and hospital service are important. In the detection of gases and their identification, reliance must be placed largely upon the sense of smell. Gas wardens and decontamination squads should be provided with special gas masks containing special inlet or sniffing valves and with protective clothing. The period of service should be short, only an hour or two because of the lack of ventilation in the gas-proof clothing. If bomb-proof shelters are provided, they should be made gas proof and ventilation provided. In attacks by persistent chemicals such as mustard gas a special squad should mark out the area of contamination, estimate the spreading of the gas in the wind and put up suitable warning signs. The decontamination squad should clean up the gas either by washing it away with water or by the use of bleaching powder. If the powder is used it should be mixed with about three times its volume of dry sand. About one pound to the square yard is necessary. Existing structures may be made gas proof and it is well to remember that none of the war gases rise to any considerable height above the street level.

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As seen from the editorial desk, the major problem in connection with the April number was what to omit. In order to devote as much space as possible to the general theme, we left out all features not bearing directly on National Defense, with the single exception of the article below, which is the concluding part of a paper started last month. *Biological Briefs, Books* and the like will of course occupy more than average space in May.

Several good manuscripts could not be printed because they were too much like others that had already been accepted. Nearly all papers were shortened, some very considerably. In some cases, as in *Chemical Warfare*, we used only the parts having biological applications.

The manuscripts for this issue were sent to the printer on February 24; this note is being inserted in the page proof on March 31; during this interval we received 17 manuscripts dealing with National Defense. It seems that the biology teachers of the country are alert to their opportunities and responsibilities in this regard.

Some of these manuscripts, almost duplicating papers already printed, have been returned. Those presenting viewpoints, techniques or phases not previously represented are being held for future issues. Throughout the duration, we shall continue to give prominent consideration to the role of biology in the defense of our nation.

Scientists' Comments on Science Club Projects

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(Continued from March)

WORTH OF THE PROJECT TO THE INDIVIDUAL

Most of those who called attention to the negative aspects of model and chart making also recognized their worth.

"I feel that whenever the material permits, demonstration dissections or preparations of the animal or plant should be encouraged rather than the making of models. Some models, especially of microscopic objects, are quite valuable teaching aids—but to the maker are more valuable as training in sculpture than in biology."—A Ph.D. candidate, Yale.

"Perhaps the photography and microscopy could be encouraged more. These techniques would, perhaps, be of more use to him later. There is a noticeable lack of original drawings."

Dr. Hadorn, a Swiss investigator, thought that "Mimicry studies, insect

collecting, habitat groups such as Boy Scouts make, etc., would be much more valuable than models which might be shown by a diagram giving three dimensions."

Mrs. Doris Spier Harman, an experienced teacher of biology and a club sponsor of Straubenmüller Textile High School of New York City, wrote, "To me, it seems unwise to allocate so much energy and time of high school students of biology to carpentry, modelling, painting and the like, since it means that there is so much less opportunity for the acquisition of biological knowledge from the study of the organisms, and for the acquiring of technical skills, as in microscopy, histology, etc. Not that children should not have their hobbies of carpentry, etc., and many, many opportunities for using tools and handling materials. But, the product should not be especially esteemed in the category of biological projects."

SOCIAL GROWTH OF ADOLESCENTS

Still another advantage accruing from active work upon projects has been forcefully expressed in this way: "I believe that the greatest value for the students lies in the social values by the club members as both boys and girls enter into team work enthusiastically for the success of their project. There is the stimulating friction of mind on mind, engendering mutual respect. There is the subordination of selfish interests. There is the taking of responsibility. There is the opportunity for the wholesome give and take of criticism, shares of dirty work, shares in approbation and the contrary, opportunities for the development of friendship with each other and their teacher-leader."

CONSTRUCTIVE CRITICISMS

Some of the constructive criticisms extended by the scientists have already been given in the part dealing with values, immediately preceding. The criticisms which follow were offered in a most friendly spirit upon the assurance that they were desired and would be received in the spirit in which they were given.

Again and again, the development of the individual was stressed. Dr. Parmenter of the University of Pennsylvania said, "If the projects can be based upon a student's *own original observations*, it is a very valuable procedure."

Dr. W. Hess of Hamilton College wrote: "In as far as such work as this *stimulates originality* it is especially commendable." "Excellent for encouraging *independent and imaginative work under control*. It must have a lasting effect in giving a sense of power to the individual," and "Has distinct possibilities for developing *individual initiative*," were other comments.

It seems as if Dr. C. E. Hadley's sug-

gestion is an especially valuable one. "The real advantages (of projects), however, can only be recognized providing the understanding of principles illustrated is carefully checked following completion of projects." This might be done by giving the student a chance to present his work in a formal talk before the club. Questions from one's own fellows are not easily bluffed. A slightly more nerve-racking procedure is to ask a student to defend his project and his knowledge of its principles before a committee of science teachers.

After the physiology lecture in the exhibit hall one morning, Dr. Robert Chambers' eye lit upon the cell models. He picked up one, with the remark "How much better this would have been if lights and shades of the same color had been used. . . ." "Oh! excuse me. Do you mean to say these are not for sale? I thought they were commercial models. They are good enough to be sold." After talking for a time, Dr. Chambers said that his "general criticism of most students today is that they are too flip. They draw conclusions on too little evidence and jump to a conclusion without seeing the evidence from each side."

LACK OF ACCURACY

One of Dr. Chambers' own students and research associates amplified his statement in this way: "The main criticism one can offer (of these projects) is the lack of accuracy in some of the exhibits and the tendency to draw generalized conclusions on the basis of insufficient, inaccurate data and superficial analysis. This is especially true of the "muscle contraction" demonstration. The conclusion is ridiculous, to say the least, and certainly not warranted by the experiments. Moreover, students of high school age could specify, even if roughly, what concentration of drug

they had used. Also, students should be trained very early to use and cite references when writing up experiments, thus establishing habits of correlating the pupils' personal experiences and ideas with those of others." Certainly, there are several good pointers in this criticism.

STUDENTS' NEED FOR HONEST CRITICISM

To aid in the development of habits of accuracy and of a scientific attitude, a medical student offered these suggestions: "The students should be honestly criticized and made to see wherein their work is crude and how it could be improved. The work need not be perfect but the students should know how to improve it and be able to judge the caliber of work not by its shine but by its accuracy and limitations. The students should not be allowed to think their work is sufficiently good for the purpose if it is not. They should realize that criticism is impersonal and that all people do not have the same abilities. The knowledge of this fact must not deter them from doing their best and in working honestly and patiently."

QUALITIES ESSENTIAL TO SPONSORS OF PROJECT WORK

However, the patience required by students is not the only ingredient of its kind which goes into successful projects. There were many who recognized the role of the teacher, and recognized that the more skillful he or she is the less obvious appears any guidance by a grown-up. Dr. D. Young of the University of Oklahoma wrote appreciatively, "These exhibits, to me, represent very excellent work on the part of the students—but back of it I see instructors who have had

the ability and energy to stimulate such interest."

Of course, the young graduate students so fresh from their own school days were quite sure that "any teacher with a little ingenuity can bring out the talent that every child has" and that "high school students will apply their talents diligently if encouraged slightly." But motherly, gray-haired Mrs. Blau had had just a little more experience in working with children. She wrote, "Highest commendation to the teachers who will see such work completed by high school students. Patience!"

In conclusion, I quote from a review of the exhibit which appeared in the summer laboratories' paper, *The Collecting Net*. It was written by Miss Virginia Mayo and Dr. G. H. Parker of Harvard and seems to summarize well the highlights of the scientists' comments:

"It is a good omen for the teaching profession, from which all others must arise, when it is so well demonstrated that it is possible to give high school students the stimulation required to produce self-activity of a high order. This is an aspect of teaching frequently discussed, but a phase of education as yet only partly realized—to learn by doing rather than by absorbing. For the latter ends with itself while the former leads to progress. Constructive self-activity of the pupil along the lines shown at the exhibition not only leads to an understanding of phenomena, which cannot be more than vague in two-dimensional print and diagrams, but also stimulates original thought. Since the latter is the first step along the path of research, it seems very fitting that there should be exhibited at Woods Hole for this brief interval a type of activity at the high school level which is the companion and progenitor of research."

